THE VETERINARY RECORD

FOUNDED BY WILLIAM HUNTING, F.R.C.V.S., 1888

No. 26. JUNE 26th, 1954 VOL. 66.

A PRELIMINARY REPORT ON HYPOTHYROIDISM IN CATTLE AND ITS POSSIBLE RELATIONSHIP WITH REPRODUCTIVE DISORDERS

BY

RUTH ALLCROFT

VETERINARY LABORATORY, MINISTRY OF AGRICULTURE, WEYBRIDGE, SURREY ;

J. SCARNELL AND S. L. HIGNETT

WELLCOME VETERINARY RESEARCH STATION, FRANT, SUSSEX

INTRODUCTION

There are relatively few references in the literature to the occurrence of abnormal thyroid conditions in cattle in Great Britain, and still fewer concerning their possible relationship with breeding problems. Hignett (1952) described an apparent clinical entity believed to be associated with an abnormal condition of the thyroid gland which he had encountered in certain high yielding herds. In a later report (1953) he suggested that thyroid glands from calves born dead in these herds were frequently larger than normal, and histological examination showed certain abnormalities thought to be associated with thyroid stimulation or resulting from previous stimulation. Because it was believed that the syndrome was related to a hypothyroid condition and, in some instances, administration of iodine appeared to be beneficial, it was necessary to find an objective test for thyroid activity. It seemed that the two best methods would involve either measurement of the uptake of radio-active iodine by the thyroid glands or estimation of blood iodine levels. Experience had been gained in the former method in sheep, but it was considered unsuitable as a field test in suspected herds. It is generally accepted that the level of organic or protein-bound iodine in the serum or plasma gives an accurate index of the amount of circulating thyroid hormone (Albert, 1952) and it was therefore decided to investigate the plasma protein-bound iodine levels in both normal and affected herds.

PROCEDURE

As far as possible, aborted foetuses from affected herds were examined in the laboratory. Microscopical and cultural examinations, with one exception, failed to reveal any organisms known to be of pathogenic significance. This exception was a herd in which organisms indistinguishable from *Vibrio fetus* were isolated from aborted twin foetuses 12 weeks of age. It is unfortunate that maceration was so marked in these foetuses that it was not possible to identify their thyroids. In the remainder, the only macroscopic abnormality noted was an enlargement of the thyroid glands, which was not evident until they were exposed. These glands were removed from the body, carefully trimmed and weighed. Approximately 1 gramme of the tissue was weighed into 20 per cent. caustic soda solution in chemically clean bottles for estimation of iodine. The remainder was fixed in 5 per cent. formol saline. Suitable portions of the fixed thyroid tissue were embedded in paraffin wax and sections 5μ in thickness were stained by the haematoxylin/eosin method.

Arrangements were made with the attending veterinary surgeon to take blood samples from a number of animals in several herds for iodine estimations. Samples were taken from adult cows only, *i.e.*, over three years old, because of reports by Long, Gilmore, Curtis & Rife (1952) and Lewis & Ralston (1953) indicating that protein-bound iodine values were considerably higher in young animals. Specially cleaned bottles containing iodine-free potassium oxalate were used for the collection of the samples. The method of analysis used was based on adaptations of the methods described by Riggs & Man (1940) and Taurog & Chaikoff (1946)

Each herd was visited and details were obtained of breeding performance, milk yield, feeding, water supply and soil type.

RESULTS

(1) *Examination of Foetal Thyroid Glands*

The breeds and ages of the foetuses, and the weight, iodine content and histological appearance of their thyroid glands are tabulated in Table I.

TABLE I
DETAILS OF FOETAL THYROIDS FROM AFFECTED HERDS

Herd ref.	Breed	Age of foetus (days)	Thyroid weight (g.)	I_2 content* (mg./100 g.)	Histology
F3	Friesian	226	11·02	3·4	Colloid : ± Cells: Columnar and invaginated.
G3	Guernsey	(a) 276 } twins	8·43	17·4	*Post-mortem* change but signs of previous stimulation.
		(b) 276 } twins	3·85	23·4	
G4	Guernsey	(a) 240	12·6	5·9	Gross *post-mortem* change.
		(b) 284	18·56	29·0	Colloid: ++ Cells: Cuboidal (high-low).

* On a fresh weight basis.

With the exception of those from the twins from herd G3, foetal thyroid glands from the affected herds weighed more than normal. Nichols, Chaikoff & Wolff (1949) studied thyroid development in cattle foetuses varying in age from 62 to 260 days as calculated from bodyweight, crown-rump length and chest and abdominal circumferences, and found that thyroids from foetuses aged between 213 and 228 days had a mean weight of 5·4 g. Full-term calves had a mean thyroid weight of 6·54 g. It is our experience that foetal thyroid glands with a normal histological appearance have weights closely approximating the mean weights quoted by Nichols *et al.* (1949). Similarly, Campbell, Hollard & Flux (1949) reported a mean thyroid weight of 6·7 g. in 709 new-born calves in New Zealand, and Jamieson, Simpson & Russell (1945) reported a mean thyroid weight of 6·5 g. in eight normal new-born Ayrshire calves.

There is little information in the literature concerning "normal" and "abnormal" values for the iodine content of bovine foetal thyroid glands. Wolff, Chaikoff & Nichols (1949) showed that measurable amounts of iodine could first

be detected at 60 days of age and that the accumulation of thyroxine-like and non-thyroxine iodine increases proportionately with increasing foetal size and age. Marine & Lenhart (1909) showed that the iodine content of the thyroid gland of cattle after birth varied inversely with the degree of active hyperplasia and established a "critical level" of 0·1 per cent. iodine on a dry weight basis or 0·03 per cent. on a fresh weight basis. If iodine values were above this critical level there were no hyperplastic changes. Comparison of the iodine values given in Table I with the critical levels established by Marine & Lenhart (1909) indicates that the iodine content is either below or near their critical figure. It is appreciated that the foetal thyroid gland does not necessarily have the same critical level and this is being investigated.

The histological examination of the thyroid gland F3 revealed evidence of thyroid stimulation. This is illustrated in Fig. 1 in which will be seen the hypertrophy of the epithelial cells which are columnar instead of cuboidal. The colloid appeared depleted as evidenced by the lack of depth in staining and the marked vacuolation. Nuclear mitotic figures were, however, infrequently seen. A section from a normal thyroid from a 210-day foetus is shown for comparison in Fig. 2.

It is essential to distinguish the abnormalities illustrated in Fig. 1 from *post-mortem* change which rapidly ensues after death of the foetus, both *in utero* before expulsion and during transit to the laboratory. *Post-mortem* change has been studied by examining sections prepared from portions of calf thyroids removed and fixed at hourly intervals after death. As will be seen from Fig. 3, the two conditions can be readily distinguished. Following *post-mortem* change, the epithelial cells tend to become detached from their basal attachments during sectioning and lie within the lumen of the follicle, some being completely disrupted. Their nuclei undergo the usual degenerative changes, whilst the colloid becomes dispersed throughout the section and is not so eosinophilic. *Post-mortem* change was superimposed on the changes indicating stimulation in the foetal thyroid glands from herd G3. In the thyroid from the eight-month-old foetus (*a*) from herd G4 (Table I), *post-mortem* change was so advanced that cellular structure was not recognisable. The thyroid gland from the stillborn calf (*b*) from herd G4 is of particular interest histologically. The findings indicate either a commencing recovery from stimulation, or commencing stimulation from a phase of low activity. Since in this herd a steaming-up ration, which included a mineral supplement containing potassium iodide, was fed to cows before calving, the first interpretation is the more acceptable.

(2) *Blood Iodine Values*

(*a*) For affected and control herds.

The organic or protein-bound, total and inorganic plasma iodine values are given in Table II.

It is evident that the mean protein-bound iodine values in the three herds F3, G3 and G4 are significantly lower than those for the other herds within each breed group ($P = 0{\cdot}01$). It is of interest that the total blood iodine values of these three herds are also significantly lower. The protein-bound iodine fraction is considered to be of greater clinical significance than the total blood iodine since, with certain reservations, it is regarded as representing the iodine of the circulating thyroid hormone and its fluctuations are regarded as reflecting thyroid activity. The results also show a definite breed difference, values for Guernseys being significantly higher than those for Friesians. This is in agreement with serum protein-bound iodine values reported by Long *et al.* (1952), but is contrary to the findings of Lewis & Ralston (1953), who reported no difference in the plasma protein-bound iodine values of Jersey and Holstein cows. The mean protein-bound iodine values given in Table II for Guernseys correspond very well with the mean of 3·51 μg. per 100 ml. serum for adult Guernseys given by Long *et al.*, but these workers found a much wider range of values (2·1 to 6·3) for 18 normal animals than was observed in the 23 normal Guernseys in the present investigation, where the range was 3·2 to 4·0 μg. per 100 ml. Similarly, in the Friesian herds the range of protein-bound iodine values in the 20 normal adult cows was 2·4 to 3·2 (mean 2·90) while Long *et al.* observed a range of 1·8 to 4·0 (mean 2·73) in 20 normal Holstein-Friesian animals. For a group of 20 normal Ayrshires, the Ohio workers gave values ranging from 1·4 to 5·7, with a mean of 3·19 μg. per 100 ml. serum, while for the same number of normal Ayrshire cows we have found values ranging from only 2·8 to 3·6 (mean 3·12) μg. per 100 ml. It is of interest, however, that on the whole, mean values for different breeds in England and in Ohio correspond so closely.

(*b*) Effect of exogenous iodine on plasma iodine values of cattle.

Although blood normally maintains a fairly constant iodine level, the value depends on the amount of iodine ingested or administered parenterally. The inorganic iodine fraction (the soluble or non-precipitable) may become greatly elevated by absorption of iodine, often from unsuspected exogenous sources. During the present investigation several remarkably high total and inorganic plasma iodine values were observed and appeared anomalous until further investigation indicated the cause. The data given in Table III illustrate this point.

Table II

Plasma Protein-Bound, Total and Inorganic Iodine Values for Affected and Control Herds

Herd ref.	Breed	Incidence of abortions and birth of dead and weakly calves.*	No. of animals sampled.	μg. Iodine/100 ml. plasma				
				Protein-bound		Total		Inorganic
				Mean	Range	Mean	Range	Mean
F1	Friesian	1 animal aborted following insemination during pregnancy	8	2·65	2·4—2·8	4·67	4·1—5·1	2·02
F2	Friesian	6·4 per cent.	12	3·07	2·8—3·2	4·25	3·6—5·7	1·18
F3	Friesian	33 per cent.	7	1·09	0·8—1·6	2·14	1·2—2·4	1·05
G1	Guernsey	Nil	11	3·31	3·2—3·6	4·46	4·0—5·3	1·15
G2	Guernsey	Nil	12	3·53	3·2—4·0	4·61	4·0—6·1	1·04
G3	Guernsey	19·0 per cent.	12	2·10	1·6—2·8	3·37	2·8—4·0	1·27
G4	Guernsey	7·2 per cent.†	11	2·36	1·6—3·2	3·33	2·8—4·5	0·97

* During 12 months preceding investigation.

† In the preceding years the incidence in this herd was 15·5 per cent., 17·8 per cent., 13·1 per cent. and 15·2 per cent. Organisms morphologically resembling *V. fetus* have been cultured from an aborted foetus in this herd.

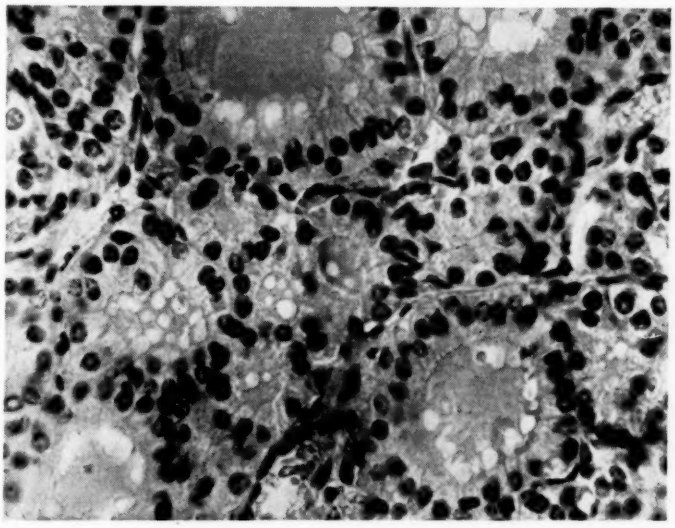


FIG. 1.—Section of stimulated foetal thyroid gland showing hypertrophy of epithelial cells and depletion of colloid. Haematoxylin and eosin. × 500.

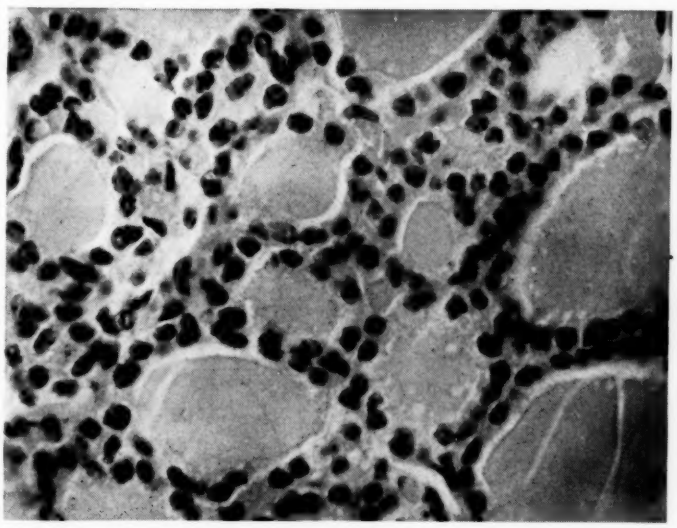


FIG. 2.—Section of normal 210 day foetal thyroid gland showing typical acinar development and cuboidal epithelial cells. Haematoxylin and eosin. × 540.

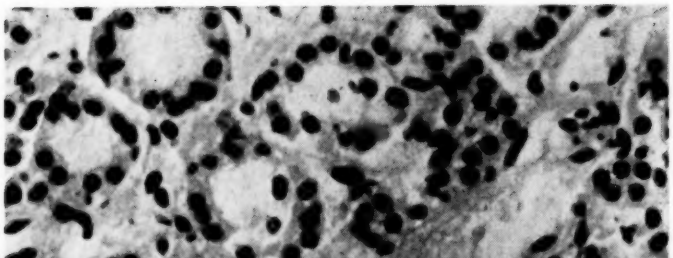


FIG. 3.—Section of foetal thyroid gland showing some of the distortions produced by *post-mortem* change. Haematoxylin and eosin. × 500.

TABLE III
EFFECT OF ADMINISTRATION OF IODINE COMPOUNDS ON PLASMA IODINE LEVELS OF CATTLE

Herd ref.	Breed	Description and number of animals	Treatment	μg. Iodine/100 ml. plasma					
				Total		Inorganic		Protein-bound	
				Mean	Range	Mean	Range	Mean	Range
A1	Ayrshire	4 milking cows	Seaweed meal included in production ration	77·2	67—87	72·9	62·7—82·6	4·4	4·0—4·8
		4 dry cows	Maintenance ration contained no iodine-rich supplement	4·85	4·0—5·3	1·4	0·8—2·1	3·45	3·0—4·4
A2	Ayrshire	4 milking heifers	Concentrates contained KI in mineral supplement	9·6	8·8—9·9	5·5	4·8—5·9	4·1	4·0—4·5
		4 milking heifers	Concentrates without a mineral supplement	4·3	4·0—4·4	1·3	1·2—1·6	3·0	2·8—3·2
G4	Guernsey	1 milking cow	Intra-uterine injection of iodine solution 2 weeks previously	167·0	—	162·4	—	4·4	—
		11 milking cows	No oral or parenteral administration of iodine	4·6	4·0—5·3	1·2	0·8—1·7	3·3	3·2—3·6

There was a very marked increase in the total and inorganic plasma iodine levels in the animals which had been fed rations containing seaweed meal rich in iodine, or concentrates containing an iodised mineral supplement, as compared with those animals in the same herds which were fed rations containing no iodine-rich supplements. The very high total and inorganic plasma iodine figures for the cow which had had an intra-uterine injection of iodine solution two weeks before the blood sample was taken, are of particular interest. The protein-bound iodine values for all the cows receiving foodstuffs rich in iodine and for the cow given an intra-uterine injection of iodine appear to be slightly elevated. The effect of a high iodine intake on the plasma protein-bound iodine level is discussed by Rapport & Curtis (1950) who suggest that it is at times confusing and incompletely understood. Reece & Man (1952) state that ingestion of inorganic iodine might elevate the iodine precipitated with protein above the "thyroxine-like" iodine compounds by as much as 10 μg. per cent. Long, Hibbs & Gilmore (1953) found enormously elevated serum inorganic iodine values as a result of thyroprotein feeding to cows, and this treatment, as would be expected, also resulted in a great increase in protein-bound iodine values. The results in Table III also demonstrate the sensitivity of blood iodine values as an index of absorption following ingestion or parenteral administration of iodine compounds and emphasise the necessity for checking every relevant aspect of the case history before interpretation of "normal" or "abnormal" blood iodine values.

(3) *Iodine Content and Total Hardness of Water Supplies of Herds Investigated*

The view that a deficiency of iodine in the drinking water plays an important part in the causation of endemic goitre (Murray, Ryle, Simpson & Wilson, 1948) is well known. Because of this the iodine content of the water supplies for each of the herds investigated was determined. Total hardness of the water, expressed as mg. of $CaCO_3$ per 100 ml., was also estimated since it has been suggested that the higher incidence of human goitre in certain areas of England, as compared with that in Scottish areas having water of similar iodine content, might be attributed to the degree of hardness of the English water in contrast to the softness of the Scottish water (Murray *et al.*, 1948). The results are given in Table IV.

The mean iodine value of 3·25 μg. per litre for the water supplied to the control herds is slightly higher than the mean of 2·87 μg. per litre for those of the affected herds, but the difference is not statistically significant. McClendon & Williams (1923) showed that areas supplied with water containing 3 μg. or more of iodine per litre were almost free of goitre. Most of the figures for the seven water supplies investigated are so near this level that from these limited numbers of observations it seems there is no significant correlation between the low protein-bound iodine values in the herds F3, G3 and G4 on the one hand, and low iodine content and degree of hardness in the water supplies on the other.

TABLE IV
IODINE CONTENT AND TOTAL HARDNESS OF WATER SUPPLIES

Identification	Incidence of abortions and birth of dead and weakly calves	Iodine (μg./litre)	Hardness as mg. $CaCo_3$/100 ml.
F1	Nil	3·0	8·2
F2	6·4 per cent.	3·2	10·4
G1	Nil	3·7	23·6
G2	Nil	3·1	8·4
		Mean 3·25	Mean 12·7
F3	33·0 per cent.	2·6	8·4
G3	19·0 per cent.	3·0	15·8
G4	7·2 per cent.	3·0	11·2
		Mean 2·87	Mean 11·8

(4) *Clinical Details of Herds*

Two breeds of dairy cattle were the main subjects of this investigation. This was determined by the fact that the syndrome was first demonstrated in the Friesian herd F3 and the Guernsey herds G3 and G4. Control herds of these breeds were therefore studied. The latter were selected on the basis of the veterinary surgeon's report that in them the incidence of abortions and/or the birth of dead or weakly calves was low. The clinical details are shown in Table V.

Since all the herds were officially milk recorded, details of milk yields were obtained from the Register of Milk Records. These yields were moderate to high and do not appear to be closely related to the syndrome.

In the herds studied, detection of oestrus was not difficult. Reproductive efficiency, as judged by the success of the first service after calving in the case of cows, and the first service ever in the case of heifers, was extremely variable. The conception rates for herds F3, G3 and G4 ranged from 16 to 83 per cent. and for herds F1, F2, G1 and G2 from 50 to 82 per cent. For these two groups the average number of services required for each pregnancy varied from 1·2 to 3,

TABLE V

MILK YIELDS AND REPRODUCTIVE EFFICIENCY OF HERDS INVESTIGATED

Herd ref.	Breed	Average milk yield (lb.) Cows	Heifers	Facility of detecting oestrus	Per cent. pregnancies to first service	Average no. services per pregnancy	Calving index	Abortions	Incidence of birth of dead and/or weakly calves	Incidence of retained foetal membranes	Incidence of *post partum* infection
F1†	Friesian	900	800	Easy	50	2·2	360	1, following artificial insemination of a pregnant cow	None	One case	None
F2†	Friesian	14100	13460	Easy	82	1·3	393	4·4 per cent.	c.2·0 per cent.	35·0 per cent.	Follows retention of foetal membranes
F3*	Friesian	11644	8501	Easy	50	2·0	427	33·0 per cent.	None	High	High
G1†	Guernsey	12000		Easy	70	2·2	440	None	None	None	None
G2†	Guernsey	9488	6178	Easy with exception of heifers in Jan.-Feb.	75	1·7	410	None	None	None	None
G3*	Guernsey	7365	6861	Easy	83	1·2	424	c.5·0 per cent.	14·0 per cent.	1, the cow which aborted twins	Few. (Actual cases not recorded)
G4*	Guernsey	7438	6027	Easy	16	3·0	406	2·4 per cent.	4·8 per cent.	50·0 per cent.	Usually follows retention of foetal membranes

* Affected herds. † Control herds.

and 1·3 to 2·2, respectively. Similarly, the calving indices* were from 406 to 427 and 360 to 440. Whilst on the basis of a single criterion there is no apparent correlation between the establishment of pregnancy and the syndrome, it will be seen that when all three criteria were adopted none of the affected herds had an entirely satisfactory level of fertility. That this cannot be considered specific is apparent from the low level of fertility in some of the control herds.

The three herds F3, G3 and G4 had a combined incidence of visible abortions and/or the birth of dead and/or weakly calves of 33 per cent. for herd F3, 19 per cent. for herd G3 and 7 per cent. for herd G4. On the other hand, with one exception, the control herds had a very low incidence of these losses. The exception was herd F2, in which the combined abortions, stillbirths and weakly calves accounted for about 6 per cent. of established pregnancies. It is considered permissible to group together aborted, stillborn and weakly calves, because it would appear that an environmental factor could lead to each of these abnormalities, the proportion depending largely on the stage of pregnancy influenced.

Retention of foetal membranes and *post-partum* infection occurred frequently in two affected herds, F3 and G4, and in one control herd, F2.

DISCUSSION

Overweight thyroid glands in new-born calves in Great Britain have previously been referred to by Jamieson *et al.* (1945) who recorded weights of 14·7 and 15·7 g. for thyroids from two oedematous Ayrshire calves and by Berger & Innes (1948), who recorded a thyroid weight of 26 g. in a "bulldog" Friesian calf, and 23 g. in a calf not so affected. Thyroid weights are perhaps of special importance to workers in the field since if the glands are normal in weight examination in the laboratory is unlikely to show evidence of present or previous stimulation.

There have been several previous descriptions of various histological appearances of foetal and new-born cattle thyroid glands. The literature is, however, somewhat confusing. Thus, Lewis & Ralston (1953) described and photomicrographed the thyroid histology of four calves slaughtered at various intervals after birth. They hold the view that there is a progressive differentiation of the epithelial cells and accumulation of colloid in the follicles after birth. It is our experience, however, that this development occurs *in utero*. The normal foetal cattle thyroid develops as cords of cuboidal cells which are recognisable before three months of age. During the next few weeks the cells become arranged into acini until by four to five months of age the central colloid is to be seen with the epithelial cells in a single layer around the periphery. The picture of thyroid stimulation which is illustrated in Fig. 1 is somewhat similar to that described and photomicrographed by Gorbman, Lissitzky, Michel, Michel & Roche (1952) in their study of the metabolism of radio-iodine by the near-term bovine foetus. These workers recorded a 25 kg. foetus as having a thyroid weight of 12·58 g. and a 50 kg. foetus as having a thyroid weight of 12·6 g. Both these glands are overweight, particularly that of the younger foetus. It is of interest that the thyroid weights of the respective dams were 43·55 g. and 29·3 g. Many of the other relevant histological descriptions are confusing, some indeed bear a striking resemblance to those illustrated as following *post-mortem* change.

Lewis & Ralston (1953) investigated plasma protein-bound iodine values in a group of 19 cows which had a history of many matings without conceptions and found that the average protein-bound iodine value of 3·7 μg. per cent. was significantly lower than an average of 4·6 μg. per cent. for normal Jersey and Holstein cows in the Michigan College herd, but was similar to an average figure of 3·3 μg. per cent. for a group of Jersey cows transported from California. Since the Michigan workers found no difference in protein-bound iodine values for the breeds studied, it is difficult to compare their data with those obtained in the present investigation.

So far as is known, there have been no other reports in the literature regarding the association of low blood iodine values with abnormal reproductive efficiency in cattle, but Man, Heinemann, Johnson, Leary & Peters (1951) presented some evidence indicating that if serum protein-bound iodine values in pregnant women do not rise above about 6 μg. per cent. during the first 16 weeks, pregnancy is unlikely to proceed to term and that abortion is more common in women whose protein-bound iodine values do not rise relatively early in pregnancy. (Normal protein-bound iodine values for the human subject lie between 4 and 8 μg. per cent. (Albert,

* Calving index = average calving interval for herd in days.

1952).) Whether or not a similar rise in protein-bound iodine values in normal pregnant cows occurs is not yet known, but the point is at present being investigated.

There has been one report on the breeding performance of cattle in which hypothyroidism was experimentally induced by thyroidectomy (Spielman, Petersen & Fitch, 1943). These workers described marked loss of libido in the bull, and inability to detect oestrus in the thyroidectomised cow. These conditions, singly or combined, would constitute a grave breeding problem in the field. There has been no opportunity to study the effect of low blood iodine values on breeding performance of the bull, because the small number of bulls so far investigated have had normal blood iodine values. As has been noted, there was no difficulty in detecting oestrus in the herds investigated. No explanation can be offered for this anomaly between the present findings and those of Spielman *et al.* Furthermore, these workers did not describe deviations from normal during the later stages of pregnancy in the thyroidectomised cow at which time their animals showed less evidence of hypothyroidism. This was attributed to the activity of the foetal thyroid gland. No parallel can be drawn between the pregnant cattle they observed and those now described, since non-surgical factors interfering with the function of the maternal thyroid would, in addition, be likely to interfere with that of the foetus. It is a common belief that with hypothyroidism milk yields are low. However, in the present series, low milk yield was not closely associated with the low blood iodine values.

There have been previous reports of thyroid changes associated with other clinical abnormalities of cattle, *e.g.*, bulldog calves in the Dexter breed (Seligman, 1904), bulldog calves in the Friesian breed (Berger & Innes, 1948) and oedematous calves in the Ayrshire breed (Jamieson *et al.*, 1945). Later evidence (Crew, 1923; Donald, Deas & Wilson, 1952) did not dispute the possible existence of the thyroid changes described, but did not substantiate the view that the association of these changes with the clinical picture was one of direct cause and effect.

It is not known whether the apparent association of hypothyroidism as reflected by blood iodine values and foetal thyroid characteristics with the clinical picture of aborted, stillborn and weakly calves is consistent or significant. The possibility exists, however, and work is continuing in an attempt to elucidate its extent and significance.

Summary

1. Hypothyroidism as evidenced by low plasma protein-bound iodine values in cattle in Great Britain has been demonstrated; values for 20 Friesian cattle from two control herds ranged from 2·4 to 3·2 μg. iodine per 100 ml. plasma, while those for seven Friesian cows from an affected herd ranged from 0·8 to 1·6 μg. Similarly, values ranging from 3·2 to 4·0 μg. iodine per 100 ml. plasma were obtained for 23 Guernseys from two control herds and values for 23 Guernseys from two affected herds were 1·6 to 3·2 μg. It was found that there was a definite breed difference regarding plasma protein-bound iodine levels in the three breeds so far studied, Guernseys being higher than Ayrshires, which were in turn higher than Friesians.

2. The foetal thyroid histology associated with the hypothyroid condition is described. Three of the cases showed evidence of stimulation which in two was partially masked by *post-mortem* change. The thyroid of a fourth case was completely disrupted by *post-mortem* change, and a fifth showed changes interpreted as representing commencing recovery.

3. The low plasma protein-bound iodine values and the histological changes in the foetal thyroids were associated with a high herd incidence of aborted, stillborn and weakly calves.

Acknowledgments.—We wish to express our thanks to Mr. F. J. Salt and Miss F. M. Sharp for technical assistance with the chemical estimations and histological examinations respectively, to Mr. E. A. Jones for preparing the photomicrographs, and to the following veterinary surgeons for their help in the investigation: Mr. J. M. Ingram, Dr. R. F. Montgomerie, Mr. P. M. F. Sambrook and Mr. H. C. Thonger.

References

Albert, A. (1952). *Ann. Rev. Physiol.* **14.** 481.
Berger, J., & Innes, J. R. M. (1948). *Vet. Rec.* **60.** 57.
Campbell, I. L., Hollard, M. G., & Flux, D. S. (1949). *N.Z.J. Sci. Tech.* **31.** 29.
Crew, F. A. E. (1923). *Proc. Roy. Soc.* Series B. **95.** 228.
Donald, H. P., Deas, D. W., & Wilson, A. L. (1952). *Brit. vet. J.* **108.** 227.
Gorbman, A., Lissitzky, S., Michel, O., Michel, R., & Roche, J. (1952). *Endocrinology.* **51.** 546.
Hignett, S. L. (1952). Proc. 2nd Int. Cong. Physiol. & Path. of Animal Reproduction and Artificial Insemination, Copenhagen. **II.** 75.
———, (1953). In "The Thyroid Gland." Memoir No. 1, Soc. Endocrinol. p. 21.
Jamieson, S., Simpson, B. W., & Russell, J. B. (1945). *Vet. Rec.* **57.** 429.
Lewis, R. C., & Ralston, N. P. (1953). *J. Dairy Sci.* **36.** 33.
Long, J. F., Gilmore, L. O., Curtis, G. M., & Rife, D. C. (1952). *J. Dairy Sci.* **35.** 603.
Long, J. F., Hibbs, J. W., & Gilmore, L. O. (1953). *J. Dairy Sci.* **36.** 1049.
McClendon, J. F., & Williams, A. (1923). *J. Amer. med. Ass.* **80.** 600.
Man, E. B., Heinemann, M., Johnson, C. E., Leary, D. C., & Peters, J. P. (1951). *J. clin. Invest.* **30.** 137.
Marine, D., & Lenhart, C. H. (1909). *Arch. intern. Med.* **4.** 440.
Murray, M. M., Ryle, J. A., Simpson, B. W., & Wilson, D. C. (1948). "Thyroid Enlargement and other changes related to the Mineral Content of Drinking Water (with a note on Goitre Prophylaxis)." Med. Res. Council Memo. No. 18. London. H. M. Stationery Office.
Nichols, C. W., Chaikoff, I. L., & Wolff, J. (1949). *Endocrinology.* **44.** 502.
Rapport, R. L., & Curtis, G. M. (1950). *J. clin. Endocrinol.* **10.** 735.
Reece, R. P., & Man, E. B. (1952). *Proc. Soc. exp. Biol., N.Y.* **79.** 210.
Riggs, D. S., & Man, E. B. (1940.) *J. biol. Chem.* **134.** 193.
Seligman, C. G. (1904). *J. Path. Bact.* **9.** 311.
Spielman, A. A., Petersen, W. E., & Fitch, J. B. (1943). *J. Dairy Sci.* **26.** 744.
Taurog, A., & Chaikoff, I. L. (1946). *J. biol. Chem.* **165.** 217.
Wolff, J., Chaikoff, I. L., & Nichols, C. W. (1949). *Endocrinology.* **44.** 510.

ROYAL ARMY VETERINARY CORPS
"AT HOME"

Mrs. A. G. Heveningham was "At Home" to officers of the Corps and their ladies in the King Charles Suite, 4, Whitehall Court, London, S.W.1, on June 11th. The following were present at this happy gathering, the eighth to be held since the war:—

Lieut.-Colonel E. Brown, Colonel and Mrs. G. Barnett, Major and Mrs. P. J. Baines, Lieut.-Colonel and Mrs. V. A. Bartrum, Mrs. R. M. Bamford, Lieut.-Colonel and Mrs. L. W. Coulden, Lieut.-Colonel and Mrs. J. Clabby, Major and Mrs. T. B. Crawford, Major J. J. Dunlop, Major, Mrs. and Miss K. A. Haines, Colonel, Mrs. and Miss C. Holland, Mrs. and Miss Hodgins, Captain and Mrs. P. A. Jenkins, Major and Mrs. W. F. Jarratt, Brigadier and Mrs. J. J. Kane, Brigadier and Mrs. G. A. Kelly, Major T. Lishman, Major and Mrs. E. H. Lewis Bowen, Captain O. Murch, Lieut.-Colonel and Mrs. J. H. McGhee, Major and Mrs. I. S. Maclennan, Colonel and Mrs. J. J. Mills, Lieutenant and Mrs. J. W. McLeod, Lieut.-Colonel L. H. Poer, Brigadier and Mrs. E. S. W. Peatt, Lieut.-Colonel and Mrs. W. M. Rouse, Major D. M. Stewart, Captain and Mrs. M. J. R. Stockman, Major, Mrs. and Miss T. L. Shea, Lieut.-Colonel and Mrs. D. F. G. Smith, Lieut.-Colonel A. D. Seton, Mrs. Tillyard, Colonel W. H. Walker, Lieut.-Colonel and Mrs. G. F. Watkins, Captain and Mrs. D. P. White, Captain and Mrs. J. R. Spurry, Major G. D. Young and Brigadier J. J. Plunkett.

THE EFFECT OF OXYTOCIC PRINCIPLE ON AN EXPERIMENTAL *STR. AGALACTIAE* MASTITIS IN GOATS

I. M. SMITH AND I. H. PATTISON

AGRICULTURAL RESEARCH COUNCIL FIELD STATION, COMPTON, BERKSHIRE

INTRODUCTION

It is widely accepted that frequent stripping of a quarter affected by mastitis helps in alleviating the condition, and that as yet no completely satisfactory treatment for the disease is available. Schipper (1953) believed that the principle of debridement was not being applied in modern therapy. He used the " milk let-down " factor, combined in some instances with antibiotics, to treat some 50 clinical cases and gave details of six field cases of acute or chronic bovine mastitis cured by the use of the hormone in doses ranging from 10 to 40 units of purified oxytocic principle. Schipper based his criterion of cure on clinical grounds and on the appearance of the milk before and after therapy. Bacteriological and other tests of the milk were not reported.

The work detailed here was done to examine the value of increased milk ejection in the treatment of an experimental mastitis in goats. It has been shown that the latter are most useful animals for studying *Streptococcus agalactiae* mastitis, and that the experimentally produced disease is similar to the naturally occurring condition in the cow (Pattison, Taylor & Holman, 1950 ; Pattison & Holman, 1951).

MATERIALS AND METHODS

The general techniques used were those of Pattison *et al.* and Pattison & Holman.

Experimental Animals.—The goats came from the population kept in isolation at this Field Station. Their husbandry has been described by Pattison *et al.*

Intramammary Test Doses.—The organism used to establish infection was *Str. agalactiae* strain Lucille (Lancefield type Ib). One ml. of an 18-hour whole Todd-Hewitt broth culture containing about 10^9 living organisms was diluted with 9 ml. of sterile Todd-Hewitt broth (Todd & Hewitt, 1932). Within 15 minutes of preparation this was injected into the teat sinus of one side of the udder with a syringe and round-ended needle.

Oxytocic Principle.—Schipper, after completely milking out and injecting oxytocic principle intravenously, allowed a few minutes to elapse before further stripping. Preliminary tests on normal goats showed that 15 units of oxytocin* caused marked release of milk within 20 minutes after intravenous inoculation, the goats having been completely milked out before the drug was injected.

Penicillin Treatment.—The infected side of the udder was treated with 10,000 units of crystalline sodium penicillin dissolved in 1 ml. of sterile normal saline, and inoculated with a syringe through a round-ended needle into the teat sinus.

TESTS FOR MASTITIS

(*a*) *Bacterial Counts.*—After 24 hours' incubation at 37° C. the number of colonies resulting from spreading 0·02 ml. of foremilk (taken with aseptic precautions) on the surface of Bactotryptose ox-blood agar plates was estimated thus : actual counts were made up to about 200 colonies ; between 200 and 500 counts were approximated to the nearest 50 ; non-confluent growth over 500 colonies was called " 750," and confluent growth, " 2,000 " colonies. The average daily count for each individual week was calculated from the geometric mean of the counts.

(*b*) *Neutrophil Counts.*—These were made by spreading 0·02 ml. of well-shaken milk over 1 sq. cm. of a slide, fixing by heat, and staining by single dip stain (Broadhurst & Paley, 1939). From the number of neutrophils present in a given series of fields, the numbers of neutrophils per ml. were estimated.

(*c*) *Whiteside Test.*—The technique was that of Murphy & Hanson (1941), in which one drop of N/1 NaOH was mixed on a glass plate with two drops of test milk. Values were ascribed thus : no reaction, 0 ; small flakes, 1 ; larger flakes, 2 ; large clumps, 3 ; confluent mucoid clot, 4.

(*d*) *Sediment Volume.*—This was measured by spinning 10 ml. of milk in graduated Trommsdorff tubes for 30 minutes at 1,500 r.p.m.

(*e*) *Clinical Examinations.*—The milk yield of both sides of the udder, the body temperature and the clinical condition of each udder were recorded twice daily.

The average daily milk yield of both sides of the udder of each goat in the pre-inoculation week was taken and subsequent daily yields were calculated as a percentage of that figure.

PLAN OF EXPERIMENT

The goats used and the details of treatment employed are given in Table I. Recording of milk yields, temperatures and clinical examinations was done twice daily for seven days before infection. Commencing three days before the introduction of the organism, daily cultural examination of the foremilk for bacteria was made, and neutrophil counts, Whiteside tests, and sediment volume measurements were carried out on the bulk milk of both sides of the udder.

TABLE I

DETAILS OF GOATS USED IN TEST OF EFFECT OF OXYTOCIN, AND OXYTOCIN AND PENICILLIN ON THE COURSE OF AN EXPERIMENTAL MASTITIS IN EIGHT ANIMALS EACH INOCULATED WITH 10^9 LIVING ORGANISMS OF *Str. agalactiae* STRAIN LUCILLE INTO THE TEAT SINUS OF ONE SIDE OF THE UDDER

Goat No.	Average daily milk yield (lb.) before infection: inoc. side	non-inoc. side	Treated with oxytocin intravenously: days after infection	Treated 15 days after infection with :—
1	1·0	0·9	Control	Pencillin
2	1·0	1·0	1	Oxytocin and penicillin
3	1·1	1·1	Control	Penicillin
4	1·2	1·1	2	Oxytocin and penicillin
5	2·8	2·9	Control	Penicillin
6	2·4	2·5	4	Oxytocin and penicillin
7	1·3	1·0	Control	Penicillin
8	2·0	2·0	4	Oxytocin and penicillin

The goats were paired according to their milk yield and, at intervals of 24, 48 and 96 hours after intramammary inoculation of strain Lucille, one goat of each pair was treated with oxytocin and the other was left as a control. Milk samples

* Pitocin (Parke-Davis & Co.)

TABLE II

RESULT OF MEASUREMENTS MADE ON MILK (TAKEN ABOUT ONE HOUR AFTER ROUTINE MILKING) FROM ONE SIDE OF THE UDDER OF EIGHT GOATS, EACH INOCULATED INTO THE TEAT SINUS OF THAT SIDE WITH 10^9 LIVING ORGANISMS OF *Str. agalactiae* STRAIN LUCILLE, NOS. 2, 4, 6 AND 8 HAVING BEEN INJECTED WITH OXYTOCIN INTRAVENOUSLY, AND FOUR CONTROL GOATS.

	Pre-injection				20 minutes after injection of oxytocin				60 minutes after injection of oxytocin.			
Goat No.	Amount milk (ml.)	Bact. count 10^4/ml.	Neutro. count 10^6/ml.	Whiteside test (units)	Amount milk (ml.)	Bact. count 10^4/ml.	Neutro. count 10^6/ml.	Whiteside test (units)	Amount milk (ml.)	Bact. count 10^4/ml.	Neutro. count 10^6/ml.	Whiteside test (units)
1	2	3·70	12·48	3	3	10·00	9·60	3	2	3·70	10·56	3
2	1	3·70	9·60	3	33	3·70	16·80	3	9	3·70	17·28	3
3	3	1·70	8·20	3	1	3·70	6·60	3	1	2·50	7·40	3
4	5	0·30	10·00	3	26	0·20	20·64	3	1	0·08	9·12	3
5	8	3·70	3·84	3	3	3·70	7·68	3	2	2·50	3·24	3
6	29	3·70	10·80	3	80	3·70	8·20	3	8	3·70	7·20	3
7	14	0·20	5·20	3	3	0·04	7·80	3	1	—	8·00	3
8	15	0·01	10·00	3	75	0·01	8·00	3	4	0·00	7·80	3

were taken just before the injection of the oxytocin, administered about one hour after the routine milking, and further samples 20 and 60 minutes later.

Fifteen days after infection the goats originally given oxytocin were treated with oxytocin and penicillin and the controls with penicillin only.

RESULTS

Intravenous injection of oxytocin caused a marked increase in the amount of milk obtainable 20 minutes later, compared with the amounts obtained from the corresponding control animals (Table II). There was no significant difference in the bacterial counts and Whiteside tests for the two groups in the milks taken 20 and 60 minutes after injection of the drug. Neutrophil counts were often considerably higher in the oxytocin-treated goats than in controls (Table II). In the control animals there was not enough milk at those times to test for sediment volume, but there was a slight increase in the sediment of samples from the oxytocin-treated animals when compared with the routine daily samples from these animals and with the controls. This result may have been due to the increased numbers of neutrophils present in those milks.

Effect of Oxytocin on the Course of the Disease.—The goats used in testing the drug were marked reactors to the intramammary infecting dose (Pattison & Holman). The results are summarised in Table III and Fig. 1, from both of which it can be seen that the tests used showed no difference in the disease between the treated animals and the control goats. Thus the average daily milk yield percentages of two oxytocin-treated goats were higher than their controls in the first week after infection, and the other two were lower than their controls. The other data were somewhat similar. In the second week after infection the average daily milk yield percentages of three treated animals were higher than their control animals and one was lower. The bacterial counts during this period were higher in the treated goats than in the control animals, with the exception of one pair (Nos. 7 and 8). No detectable differences were noted in the clinical responses to infection in the two groups.

Since oxytocin alone appeared to have no value in decreasing the severity of the mastitis, oxytocin and penicillin treatments were combined. In the third week the average daily milk yield percentages were higher in two oxytocin and penicillin-treated goats compared with their controls, which received penicillin only; the other oxytocin and penicillin-treated animals had lower milk yield percentages than the corresponding control goats. It was also noticeable that the average daily bacterial counts of the third week for the four oxytocin-treated goats were higher than those of the controls.

It was clear that oxytocin did not act as an adjuvant to penicillin in combating the disease.

TABLE III

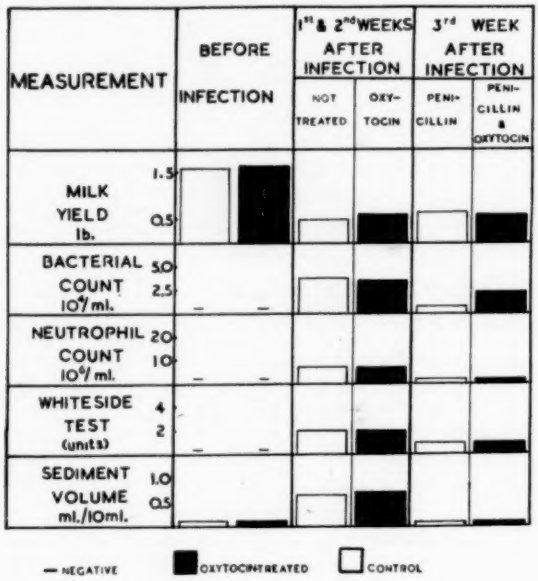
THE DAILY AVERAGE RESULTS FOR THE INFECTED SIDE DURING :—*1st and 2nd weeks*, THE EFFECT OF 15 UNITS OXYTOCIN INOCULATED INTRAVENOUSLY INTO GOATS NOS. 2, 4, 6 AND 8 ON THE COURSE OF MASTITIS PRODUCED BY INOCULATING 10^9 LIVING ORGANISMS OF *Str. agalactiae* STRAIN LUCILLE INTO THE TEAT SINUS OF ONE SIDE OF THE UDDER; AND *3rd week*, THE EFFECT OF INJECTING 10^4 UNITS PENICILLIN INTO THE INFECTED SIDE OF THE UDDERS OF GOATS NOS. 1 TO 8, AND 15 UNITS OXYTOCIN INTRAVENOUSLY INTO GOATS NOS. 2, 4, 6 AND 8

	Milk yield per cent.		Bact. count	Neutro. count	Whiteside test	Sed. volume
Goat No.	inoc. side	non-inoc. side	geom. mean 10^4/ml.	10^6/ml.	(units)	ml./10ml.
WEEKS AFTER INFECTION						
1st week (with Oxytocin)						
1	62	126	2·7	8·73	3	0·5
2	66	100	2·0	6·47	3	0·3
3	7	88	3·3	13·43	3	2·0
4	50	104	2·64	9·06	3	0·5
5	32	102	2·6	7·35	3	0·3
6	25	80	3·4	12·50	3	0·5
7	44	80	2·5	8·93	3	0·5
8	31	97	2·2	11·17	3	0·3
2nd Week						
1	94	157	2·6	5·03	2	0·2
2	86	138	2·8	5·65	2	0·2
3	5	96	2·9	2·50	2	0·3
4	15	93	3·4	14·17	3	3·0
5	16	110	2·7	10·28	3	0·8
6	25	87	3·1	7·20	2	0·1
7	30	98	3·1	12·70	3	1·0
8	42	95	2·1	4·06	2	0·1
3rd Week (with Oxytocin and Penicillin)						
1	113	160	2·1	2·41	1	0·1
2	97	113	2·3	0·95	2	0·1
3	5	91	0·6	0·27	0	0·1
4	12	127	1·7	4·02	2	0·3
5	18	123	0·4	3·98	2	0·2
6	21	88	2·9	6·95	2	0·1
7	77	114	0·4	4·73	2	0·1
8	55	96	0·6	0·66	1	0·1

Bacterial, and neutrophil counts, and Whiteside tests made on non-inoculated sides of each goat at the same times were all negative and sediment volumes were always $<0·1$.

FIG. 1

THE DAILY AVERAGE RESULTS FOR THE INFECTED SIDE OF THE UDDER OF EIGHT GOATS EACH INOCULATED INTO THE TEAT SINUS OF ONE SIDE OF THE UDDER WITH 10^9 LIVING ORGANISMS OF *Str. agalactiae* STRAIN LUCILLE, OF FOUR GOATS TREATED WITH 15 UNITS OXYTOCIN INTRAVENOUSLY (1ST AND 2ND WEEKS), AND 10^4 UNITS PENICILLIN INTO THE TEAT SINUS (3RD WEEK), AND FOUR CONTROL GOATS TREATED WITH 10^4 UNITS PENICILLIN INTO THE TEAT SINUS (3RD WEEK)



DISCUSSION

As already stated Schipper reported that oxytocic principle, combined in some instances with antibiotic therapy, was used effectively in 50 field cases of acute or chronic bovine mastitis and he gave details of six. It must be pointed out, however, (*a*) that the etiology of the mastitis with which he was dealing was unknown, (*b*) that the effect on milk yield of the mastitis and of the therapy applied was not measured, (*c*) that the criteria of recovery following treatment were clinical only. It is well known (and Little, Brown & Plastridge, 1946 ; and Howell, Pattison, Holman & Smith, 1954, have drawn attention to the fact) that milk of normal appearance can be obtained from cows harbouring *Str. agalactiae*, so that true evaluation of a line of therapy is impossible without cultural examination of the milk.

While theoretically oxytocin, by increasing the amount of milk obtainable, and hence the amount of debris withdrawn in mastitis, would appear to be a useful adjunct in mastitis therapy, our results in experimentally infected goats have failed to lend support to Schipper's contention. He believed that the milk ducts are blocked by the organisation of clotted debris ; Pattison (1951) showed that these duct structures were invaginations of granulation tissue through the epithelial lining of the smaller ducts and that in untreated animals the ingrowths break down and are shed about three weeks after infection.

We realise that it cannot be inferred from the results in this experiment with goats that oxytocin treatment would be valueless in all types of bovine mastitis, but we believe reports of its efficacy should be treated with caution, especially in the absence of critical experimental work in cattle.

SUMMARY

Under experimental conditions the use of oxytocin, either alone or in conjunction with penicillin, had no effect on the course of an experimental mastitis produced in goats by *Str. agalactiae*.

Acknowledgments.—We are grateful to G. N. Henderson, Esq., B.SC., M.R.C.V.S., of Parke-Davis & Co., for arranging the supply of oxtocin which was given gratis. Thanks are also due to Mr. F. Summerfield, of this laboratory, for photographing the illustration.

REFERENCES

BROADHURST, J., & PALEY, C. (1939). *J.A.V.M.A.*, **94.** 525.
HOWELL, D. G., PATTISON, I. H., HOLMAN, H. H., & SMITH, I. M. (1954). *J. comp. Path.* In Press.
LITTLE, R. B., BROWN, J. H., & PLASTRIDGE, W. N. (1946). *In* LITTLE & PLASTRIDGE, *Bovine Mastitis.* (1946). McGraw-Hill Book Co., New York.
MURPHY, J. M., & HANSON, J. J. (1941). *Cornell Vet.*, **21.** 47.
PATTISON, I. H. (1951). *J. comp. Path.* **61.** 71.
———, & HOLMAN, H. H. (1951). *Ibid.*, **61.** 26.
———, TAYLOR, J. I., & HOLMAN, H. H. (1950). *Ibid.* **60.** 71.
SCHIPPER, I. A. (1953). *Vet. Med.* **48.** 401.
TODD, E. W., & HEWITT, L. F. (1932). *J. Path. Bact.* **35.** 973.

GOOD PROGRESS IN AREA ERADICATION PLAN FOR TUBERCULOSIS

In a communication recently received, the Ministry of Agriculture states that in the three and a half years since the area eradication plan for tuberculosis was introduced, the number of cattle in attested herds has more than doubled. At the end of March this year there were about 4·55 million cattle in attested herds, compared with only 2·25 million in October, 1950. Forty-eight per cent. of all cattle in Great Britain are now in attested herds; in England over 40 per cent., in Wales nearly 69 per cent., and in Scotland nearly 67 per cent.

On January 1st, 1954, three areas, two in Wales and one in Scotland, were declared Eradication Areas. They are: that part of the county of Pembroke not included in the existing Attested Area in South-West Wales; that part of the county of Glamorgan west of the Swansea valley, including the Gower peninsula, and the Bettws Mountain district of Carmarthen; and the counties of Dunbarton, Lanark, Peebles and Stirling.

At the end of 1953 78,250 of the 85,600 cattle in the two areas in Wales were already in herds attested or supervised under the voluntary Attested Herds Scheme. At the first round of compulsory tests of the remaining 7,350 cattle the incidence of reactors was 22 per cent.; but at the second round only 2 per cent.

The area in Scotland contains 171,500 cattle, of which all but 1,050 were in attested or supervised herds. The incidence of reactors at the first round of tests of these 1,050 cattle was 22 per cent.; but at the second round less than 1 per cent.

For practical purposes bovine tuberculosis is now non-existent in these three areas. The Minister has, therefore, made Orders adding these areas from July 1st to the Attested Areas which they adjoin.

There are four more areas, one in Northern England, one in Wales and two in Scotland, where since March, 1953, free tuberculin tests have been provided with a view to their declaration as Eradication Areas in March, 1955. They are: Cumberland and Westmorland, and parts of adjoining counties; Merioneth, Montgomery, Brecon and Radnor; Midlothian, West Lothian, Fife, Clackmannan, Selkirk and Kinross, and parts of Argyll, Perth and Inverness; and the Outer and Inner Hebrides.

These areas together contain over 800,000 cattle. Satisfactory progress has been made, and more than 4,600 herds have already qualified for entry to the Attested Herds Scheme with the help of the free tests. It is hoped that by the time the areas become Eradication Areas only a relatively small number of herds will remain to be dealt with compulsorily.

CLINICAL COMMUNICATIONS

SUSPECTED POISONING IN A DOG BY ONE OF THE NEW ORGANO-PHOSPHORUS INSECTICIDES

W. B. FAULL and J. S. WILKINSON
Royal Veterinary College, Clinical Department, Wallingford

The paper entitled "The Toxic Hazards of the Newer Insecticides and Herbicides," by McGirr & Papworth (1953) (*Vet. Rec.* **28.** 859), prompts us to record a suspected case of tetraethyl pyrophosphate (TEPP) poisoning in a dog.

Animal.—Ten-week male Dachshund.

History.—A market gardener, inexperienced in the use of the organo-phosphorus insecticides sprayed some tomato plants with TEPP at approximately 11 a.m. About 15 minutes later his puppy was seen licking these plants and two hours later (1.15 p.m. approximately) the puppy quite suddenly appeared drowsy and inco-ordinate and vomited food material. The dog had been with the owner all the morning, and its condition could not be attributed to any factor other than ingestion of the insecticide.

Symptoms.—The puppy was brought to us at 2 p.m. showing symptoms of collapse. There was marked ataxia and almost complete absence of muscle tone. The temperature was 98° and the mouth cold, the mucous membranes were pallid and the pulse very weak and rapid ; the pupils were not noticeably constricted. The puppy's condition was clearly deteriorating even during the period of examination.

Diagnosis.—Suspected TEPP poisoning.

Treatment.—On the container of the insecticide, supplied by the owner, atropine sulphate was named as the specific antidote, and 1/300 gr. was injected subcutaneously. Concentrated saline was given by mouth promoting further vomiting, and 1 c.c. coramine and 20 c.c. warm glucose-saline were also injected subcutaneously.

The owner massaged the patient with towels for half an hour, and maintained warmth with hot-water-bottles. There was no obvious improvement for 15 minutes, but within half an hour the puppy was brighter and muscle tone was rapidly returning ; the pupils were now widely dilated by the atropine ; within an hour the patient was walking almost normally.

At 9 a.m. the following day, the owner reported that the puppy had drunk milk and glucose during the night without further vomiting, and apart from slight dysentery it appeared normal.

We found the patient bright and active, mucosae normal, mouth warm and the pupils still partially dilated ; the temperature was normal, but the thermometer was noticed to be bloodstained. Mist. Bism. Sed. was prescribed, one teaspoonful twice daily, and this was given for three days, by which time the patient had made a complete recovery.

Observations

The pharmacology and toxicity of the organo-phosphorus insecticides have now been recorded in much detail, and it is interesting to compare some of the experimental findings with this case.

1. The time interval of approximately two hours, between ingestion of the poison and commencement of symptoms is within the interval range described by Bidstrup (1950) in human cases, and McGirr & Papworth (1953) in animal experiments.

2. The puppy showed no signs of salivation, dyspnoea, tenesmus, micturition and muscular twitchings, symptoms prominent in the experiments of Dayrett, Manry & Seevers (1948), but these workers do state that there is no definite sequence in the onset of symptoms.

3. The startling rapidity with which the dog recovered suggests that a specific antidote was used, and this is supported by Dayrett, Manry & Seevers (1948), who state that a dog showing bradycardia, dyspnoea, tremors, convulsions and prostration, can walk about practically symptom-free within a few minutes of intravenously injecting atropine in an adequate dose.

4. Dayrett, Manry & Seevers (1948) and Bidstrup & Denz (1950) emphasise that atropine acts principally against the muscarine action of the organo-phosphorus compounds, and it is therefore perhaps a little surprising that this patient recovered so rapidly, as the main symptoms were ataxia and collapse, *i.e.*, nicotinic effect, and not those of simple excess parasympathetic activity ; but perhaps the extreme youth of the patient altered the course of the symptoms and the recovery.

Summary

1. A suspected case of TEPP poisoning in a dog is described.

2. This case is compared with the reports of the toxicity of the organo-phosphorus compounds in man and experimental animals.

Acknowledgments.—We thank N. K. Smith, B.Sc., of the Murphy Chemical Company, for his interest and for providing some of the references, and J. W. H. Holmes, M.R.C.V.S., D.V.S.M., for help in preparing this communication.

References

McGirr & Papworth. (1953). *Vet. Rec.* **28.** 859.
Bidstrup. (1950). *B.M.J.* 273 and 548.
Denz. (1950). *B.M.J.* 274.
Dayrett, Manry & Seevers. (1948). *J. Pharm. Exp. Therapeutics.* **92.** 173.

* * * * *

TREATMENT OF ANOESTRUS IN THE MARE BY UTERINE IRRIGATION

JOHN BURKHARDT
Thirsk, Yorks

At this time of the year, in case there are some veterinary surgeons who are not yet familiar with this form of treatment, the following brief note is offered for their assistance.

In the writer's experience over the past eight years, treatment of anoestrus by hormone injection is somewhat unreliable and not entirely satisfactory in its results.

With the exception of stilboestrol diproprionate in doses of 8 to 10 mg. no hormone treatment has proved worth while. Irrigations of the uterus with a quart of normal saline or boiled water warmed to about 106° F., to which 15 grains of Chinosol have been added have given results so satisfactory that it is now used in this country as a routine treatment where the state of the mare warrants. These conditions will be dictated by time of the year and the condition of the ovaries. Where follicular development is palpable the results are almost uniformly good.

Irrigation may be performed with a "one-way" catheter attached to a Higginson syringe or by means of a funnel and foal's stomach tube. The cervix is first dilated by the left hand, the catheter is introduced by the right hand and the solution introduced directly into the uterus, whilst the stud groom holds the tail to one side and the vessel containing the solution in his other hand.

In maiden and barren mares results are almost always good, signs of oestrus appearing at intervals varying from

48 to 96 hours. These results were also obtained by Mr. Allen Baker in Eire.

In the writer's experience follicular development follows irrigation. The mode of action is possibly by nervous reflex from the uterine sensory nerve endings via the thalamus to the pituitary.

In foaling mares the response, though adequate, is not quite so reliable and where two successive irrigations have failed at a week's interval the third may be supplemented by an injection of stilboestrol diproprionate.

No further details will be given here since the results of eight years' treatment by this method are now in preparation for publication. The credit for the development of this technique in England should be ascribed to the Animal Health Trust, since it was investigated whilst holding a Research Fellowship at the Equine Research Station, Newmarket.

REFERENCE

ALLEN BAKER, M.R.C.V.S., Lismacue. (1945). Personal communication.

FIELD APPLICATION OF DEEP FROZEN SEMEN

In submitting the Report at the Annual General Meeting of the Hampshire Cattle Breeders' Society Ltd., held on June 17th at the Polygon Hotel, Southampton, Mr. G. N. Gould, M.R.C.V.S., J.P., the Society's Chairman, said:

"The increased demand for the Society's services resulted in 34,465 cows and heifers being inseminated, which is about 36 per cent. of the total stock available for insemination. A conception rate of nearly 64 per cent. was achieved.

"By far the most important feature of the year's work has been the remarkably successful field application of the deep-freeze method of storage of semen.

"Last year, at the Annual General Meeting, I intimated that this technique had been introduced at Lyndhurst in the previous March after considerable preparatory work with the full co-operation and supervision of Mr. L. E. A. Rowson, M.R.C.V.S., of Cambridge. Subsequently the translation of the technique to field requirements of the main Centre and later the sub-Centres was achieved.

"Developments in methods of refrigeration—in conjunction with refrigeration experts—have resulted in the provision of more satisfactory equipment; but there is still room for further development which will undoubtedly come in the near future.

"The cost of maintenance of deep-freeze units throughout the main and three sub-Centres amounts to about £140 per month. While this may sound expensive it provides the means of giving a nominated service to any of the Society's bulls (this amounts to 7 per cent. of total first inseminations) and of providing services to minority breeds —such as the use of a single Hereford and Aberdeen Angus bull to satisfy the demands of the Centre—economically. It removes the criticism that a farmer could not have the bull of his choice for his herd.

"There is little doubt in my mind that the future of artificial insemination is in the long-term storage of semen, such as that provided by the deep-freeze method. Its full and proper application will permit not only nominated service but economy of operation which will bring reduced costs in the future when fully exploited.

"With the application of the deep-freeze process of storage of semen it has become more and more urgent that improved premises be made available as soon as practicable. It is for that reason that the reserve for building, amounting to £21,500, has been built up. The premises sub-committee are looking for a suitable site, and attention is being given to plans and requirements of the Centre of the future.

"Deep-freeze permits a flexibility of management of the bulls, and of administration and working of the Centre and sub-Centres, which have yet to be fully appreciated. The developments in technique in the laboratory at the Centre, which appear to provide a basis for the selection of semen prior to freezing which is likely to be of satisfactory fertility, may prove of outstanding importance in the future. It emphasises the need for adequate and vastly improved laboratory facilities. The addition of highly qualified technical staff has been necessary, and is indicative of the importance attached to laboratory handling and requirements

"From March to May, 1953, 895 trial first inseminations were carried out using deep-frozen semen at an average conception rate of 53·1 per cent. Since June, 1953, 12,000 deep-freeze inseminations have been carried out at an average conception rate of 60·6 per cent. 1,750 calves have been born in Hampshire, and the Isle of Wight, from deep frozen semen.

"It is interesting to relate that semen of certain outstanding bulls which have been slaughtered is still available and in use in the Society's centres.

"The difference in conception rate of deep-freeze semen and that of semen in ordinary dilution has varied from 7 per cent. to 3 per cent. lower. With selection of semen the gap is narrowing, and with further development we anticipate continued improvement in the future, which will permit a complete deep-freeze service with little or no percentage loss of conception rate, and possibly improved conception rate.

"It would appear that the Hampshire Cattle Breeders' Society has made greater progress with the field application of deep-freeze stored semen than any other A.I. organisation, and we have great faith in its future. At the present moment we have over 25,000 doses of deep-freeze semen in store, a high proportion of which is selected semen.

"We are indeed grateful to Mr. Rowson, to our veterinary surgeons—Messrs. Bennett and Madden—and to our laboratory staff, for their great contribution to the success achieved."

REPORT

Milk Marketing Board. Report of the Production Division No. 4, 1953

The latest report of the Production Division of the Milk Marketing Board contains important statistical information regarding the Dairy Industry in England and Wales, together with details of various investigations and experiments that the Board have been undertaking. During 1953 record sales of milk were made off the farms; at the same time the Government made the decision to restore marketing powers to the Board.

From 1943 to 1953, the proportion of attested cattle increased from 6 to 40 per cent. Average yields in recorded herds rose from 6,821 lb. in 1942-43 to 7,785 lb. in 1951-52.

From the results of the Board's heifer lactation investigation, now in its fourth stage, the important influence on yields of calving interval has been studied. The adverse effect, on yield, of calving within a one year interval is shown, as well as the effect of excessively long intervals which are accompanied by only average yields.

A new method of evaluating progeny test results—providing what is known as the relative breeding value of a dairy sire—is described. Statistics given on artificial insemination show that 39 per cent. of the cows in England and Wales are now inseminated artificially. The overall conception rate for 1952–53 was 67·2 per cent.

Veterinary investigations reported include the experiences in cabinet constructions for the long term preservation of frozen bulls' semen. The lead in design by using solid CO_2 blocks housed in insulated boxes came from the Cambridge workers, Messrs. Rowson and Polge. Report is also made on the successful shipment of frozen semen.

Field investigations into herd infertility in the Beccles centre area, surveyed 95 herds following reports of low herd conception rates. From the evidence collected, there was no indication that in the area covered, artificial insemination was responsible for the spread of vibriosis, but the incidence in herds using natural service was found to be quite extensive—indicating the need for adequate veterinary inspection before introducing new stock into a herd. Examination revealed a high incidence of herds (61 out of 95) with below average conception rates unassociated with apparent infectious agents. The survey has shown that more attention still needs to be paid to the effect of soil type, feeding practice and breeding management on female fertility before the conception rates on certain farms can be improved upon.

A further investigation was concerned with observations on male fertility in natural service herds which were known to be passing through a sub-fertile or totally infertile period. 65 bulls were included in the survey which showed 30 per cent. to be permanently sterile, 25 per cent. sub-fertile, and 41 per cent. of normal fertility but being used in herds with breeding problems of probably female origin. From this investigation it appeared, therefore, that in herds with breeding problems, the bull was just as responsible as the cow.

Details are given of the Board's plan for the field progeny testing of bulls for use in artificial insemination, and of the joint project with the British Oil and Cake Mills of a bull testing station on the Danish pattern. Also given in this valuable report is information on some of the bulls at the Board's cattle breeding centres, and appendices of regional and breed differences of yields in recorded herds.

ABSTRACTS

Isolation of Virus in Mice*

Horses are immunised annually in South Africa with polyvalent vaccines of mouse-brain adapted strains of virus. A few immunised horses develop the natural disease each season although blood from them often fails to yield virus by intracerebral inoculation into unweaned mice. Nevertheless, such blood will infect susceptible horses and from these may be easily transferred to mice. Author shows that blood samples neutral for mice will produce a temperature reaction in ferrets, especially if administered intracardially, and that ferret blood and spleens at the time of the reaction are infective for mice; probably dogs can be substituted for ferrets. Attempts to reactivate for mice natural serum virus mixtures from breakdown cases using techniques involving centrifugation, dilution, and blind passage, were unsuccessful; yet experimental mixtures of the virus when it had been reactivated by inoculation into a susceptible horse and serum from the breakdown case, retained some infectivity for mice. Blood from two immunised horses at the time of breakdown illness possessed satisfactory levels of antibody for all strains of virus incorporated in vaccine, and virus from one of them, after full adaptation to mice, was neutralised by homologous serum and by sera against two of the vaccine strains. Author suggests that breakdowns are due to infection with virus in a phase of " non-neutralisability."

A. W. G.

* * * * *

Neutralisation Test for Distemper*

The authors develop a neutralisation test in fertile eggs using Haig's egg-adapted virus and sera from mink and ferrets. Constant amounts of virus were mixed with dilutions of test serum and allowed to stand for 48 hours at 5° C., dilutions of virus without serum being included in order to determine the ID_{50} of virus used in the neutralisation test. The number of eggs at each dilution observed to be infected enabled calculation of the dilution of test serum which would neutralise the virus in 50 per cent. of eggs. Results were shown to depend upon the amount of virus used in the test. While the dose could be approximately adjusted to 100 ID_{50} by a previous titration, its exact value in a test was not known until after the test. Consequently, critical comparisons between sera should be included in the same experiment. Ferrets vaccinated with egg-adapted virus became resistant to challenge with virulent virus within two days, whereas antibody was not demonstrable in their sera until the seventh day after vaccination. Neutralising antibodies were detected in all of nine unvaccinated mink in contact with naturally infected ferrets. Sera from animals which had had no contact with distemper virus did not neutralise it.

A. W. G.

* **Studies on an *in avo* Neutralisation Test for Distemper.** Baker, G. A., Gorham, J. R., & Leader, R. W. (1954). *Amer. J. vet. Res.* **15.** 1202–107.

IN PARLIAMENT

Protection of Animals (Anaesthetics) Bill

This Bill, which is sponsored by the B.V.A., had an unopposed Second Reading in the House of Lords on June 22nd. It has already passed through all stages in the House of Commons.

* * * * *

Questions

Atrophic Rhinitis

Sir L. Plummer (June 17th) asked the Minister of Agriculture what steps he is taking to prevent the spread of the pig disease, atrophic rhinitis.

Mr. de Freitas asked the Minister of Agriculture what steps he is taking to prevent the disease being spread in Great Britain from Northern Ireland, the Channel Islands and the Isle of Man by apparently healthy Landrace pigs imported from Sweden within the last few months.

Sir T. Dugdale: I would refer the hon. Members to the reply I gave to my hon. and gallant Friend the Member for Berwick and East Lothian (Major Anstruther-Gray), on May 27th. Since then I have made orders prohibiting the importation of all pigs, except for immediate slaughter, from the Channel Islands and Northern Ireland, both of which recently imported Landrace pigs from Sweden. I have not thought it necessary to extend this prohibition to the Isle of Man, because the Landrace pigs imported

* **The Isolation of Virus in Mice from Cases of Horse-sickness in Immunised Horses.** McIntosh, B.M. (1953). *Onderstepoort J. vet. Res.* **26.** 183–195.

there are being detained in the island and are isolated from other pigs.

Mr. T. Williams: Has this disease afflicted, or is it afflicting, any of our pigs?

Sir T. Dugdale: If the House will bear with me for a few moments I will give the latest information. The disease has been confirmed in three young pigs, as I informed the House recently. They came out of an in-pig gilt which was imported from Sweden and auctioned at Peterborough last year. The first case was confirmed on May 19th and the other two on June 1st and 3rd. Two of these pigs have been slaughtered and the third has been kept alive under observation at the Ministry's laboratory at Weybridge.

These three pigs, in turn, were moved on to three separate farms and all the 659 pigs on those farms have been under suspicion. The slaughter of one entire herd of 443 pigs on one of these farms was completed yesterday as the disease was clearly spreading there. A *post-mortem* on these animals is being carried out at once.

NOTES AND NEWS

Diary of Events

June 30th.—Annual General Meeting of the Southern Counties Division, B.V.A., at Westgate Lodge, Winchester, 6.30 p.m.

July 7th.—Meeting of the Editorial Committee, B.V.A., at 7, Mansfield Street, Portland Place, W.1, 2.30 p.m.

July 8th.—General Meeting of the East Midlands Division, B.V.A., at the School of Agriculture, Sutton Bonington, 2.15 p.m.

July 14th.—Annual General Meeting of the Southern Region of the A.V.T. and R.W.s at the Royal Veterinary College Field Station, Streatley.

July 15th.—Annual General Meeting of the Northern Region of the A.V.T. and R.W.s at the Veterinary Science Division, Boot's Pure Drug Co. Ltd., The Priory, Thurgarton, Notts, 12 noon.

July 28th.—Meeting of the Supplementary Veterinary Division, B.V.A., at 7, Mansfield Street, Portland Place, London, W.1, 2 p.m.

Sept. 19th—25th.—72nd Annual General Meeting and Congress of the British Veterinary Association at Torquay.

* * * * *

July Meetings of Council and Committees, B.V.A.

Wednesday, July 21st, 1954:—

11.0 a.m. Organising Committee.
2.0 p.m. Home Appointments Committee.
3.30 p.m. Parliamentary and Public Relations Committee.
At 7, Mansfield Street, Portland Place, W.1.

Thursday, July 22nd, 1954:—

10.30 a.m. Veterinary State Medicine Committee.
1.45 p.m. Finance Sub-committee.
2.30 p.m. General Purposes and Finance Committee.
At 7, Mansfield Street, Portland Place, W.1.

Friday, July 23rd, 1954:—

10.30 a.m. Council Meeting.
At the Connaught Rooms, Great Queen Street, W.1.

* * * * *

R.C.V.S. Examinations

Monday, June 28th.—M.R.C.V.S. Practical and Orals commence (Panels "A" and "B").

* * * * *

R.C.V.S. DIPLOMA IN VETERINARY STATE MEDICINE

On the results of the examination held by the Royal College of Veterinary Surgeons in Edinburgh from June 10th to 15th, 1954, the following candidates have been awarded the Diploma in Veterinary State Medicine: John David, Joyce Harding, Charles Patrick Mackenzie, Iain McLachlan and Geoffrey Robin Smith.

PERSONAL

Births.—Bradley.—On May 11th, 1954, at Parkstone, Dorset, to Marguerita, wife of John F. Bradley, M.R.C.V.S., a third son—John Francis.

Penhale.—On June 18th, 1954, at the Old Tree Maternity Home, Launceston, to Pamela (*née* Chittenden), M.R.C.V.S., wife of Allin Penhale, B.Sc., M.R.C.V.S., of Holsworthy, Devon, a daughter.

* * * * *

MR. G. N. GOULD

At a meeting of the Governors of King Edward VI School, Southampton, Mr. G. N. Gould, M.R.C.V.S., J.P., was re-appointed Vice-Chairman. The School recently celebrated its fourth centenary.

* * * * *

CAPTAIN J. W. PROCTER

The following members of the profession attended the funeral of Captain J. W. Procter, which, as reported last week, took place at Holy Trinity Church, Micklegate:—

Messrs. H. B. Allen (Superintending V. O., Yorks) (Harrogate), G. G. Alton (F.A.O.) (Tunis), E. V. Fawell (York), R. Hayes (Sherburn-in-Elmet), T. C. Hall (Knaresborough), C. Hetherton (Malton), W. S. Johnstone (York), T. Johnston (Divisional V.O., Yorks, N. Riding) (Northallerton), F. Lofthouse (Otley), W. R. McKinna (Huddersfield), G. S. Powley (Wetherby), Dr. K. C. Sellars (Leeds), Mr. H. Sumner (Liverpool), Colonel Stalker (Avonbridge, Stirlingshire), Messrs. D. Sillars (York), G. N. Sutherland (York), E. Varley (Divisional V.O., Yorks, E. Riding) (Beverley), G. V. Tyerman (Wetherby), and Mr. and Mrs. J. P. Wilmot-Smith (Pontefract).

* * * * *

ROYAL SANITARY INSTITUTE

At an examination for Inspectors of Meat and Other Foods, held in Liverpool on May 28th and 29th, 36 candidates presented themselves. The following 18 candidates passed the examination: Barnes, Eric Foster; Beetham, Kenneth Campbell; Bush, David Gerald Ernest; Candlin, John Walter; Forrest, William Frederick; **Frost, Horace Bernard; Goulden, Joseph;** Holford, John; Jagger, Douglas Desmond; Mensah, William Frederick Osabu; Newbold, Peter Howarth; Peries, Mihidculasuriya Joseph John; Smith, Gilbert Cyril; Vaughan, Robert Benjamin; Wenn, Arthur; Weston, Kenneth Francis; Williams, John Edward; Wynn, George Angus.

* * * * *

ANIMAL HEALTH TRUST RESEARCH TRAINING SCHOLARSHIPS

The Animal Health Trust recently awarded scholarships to the following: Mr. R. M. Barlow, who is at present staying at Edinburgh University; Mr. L. A. Hemsley, of the University of Bristol Veterinary School; Mr. I. F. Duthie, of Glasgow University; Mr. G. R. Smith, M.R.C.V.S., who hopes to undertake research in Bacteriology and Virology at Manchester University under Professor Maitland, and Mr. Charles Dow, of Glasgow University.

Each of these gentlemen has been recommended by his Professors as a suitable candidate for higher veterinary education.

* * * * *

ROYAL ARMY VETERINARY CORPS OFFICERS CLUB

The annual dinner of the R.A.V.C. Officers Club was held at Grosvenor House, Park Lane, W.1, on June 11th. Brigadier A. G. Heveningham, C.B.E., Director, Army Veterinary and Remount Services, presided, and General Sir Ouvry L. Roberts, G.C.B., K.B.E., D.S.O., M.A., Quartermaster-General to the Forces, and Dr. W. R. Wooldridge, M.Sc., M.R.C.V.S., F.R.I.C., President of the Royal College of Veterinary Surgeons, were the guests of the evening.

The following officers were also present, a total of 68 in all:—

Brigadiers J. J. Plunkett, C.B.E., G. A. Kelly, C.B., E. S. W. Peatt, O.B.E., and J. J. Kane, O.B.E.

Colonels H. E. Gibbs, D.S.O., G. F. Steevenson, O.B.E., W. H. Walker, D.S.O., O.B.E., G. Barnett, O.B.E., J. J. Mills, and C. Holland, M.C.

Lieut.-Colonels J. L. Dalzell, J. Sealy Green, L. H. B. Poer, M.C., D. I. C. Tennant, D. F. G. Smith, O.B.E., G. F. Watkins.

V. A. Bartrum, O.B.E., J. Daly, W. M. Rouse, J. Bell, R. H. Knowles, G. L. Beaumont, W. M. Rowston, A. D. Seton, J. Clabby, M.B.E., B. C. L. Edmonds, J. H. McGhee, D. A. Green and L. W. Coulden.

Majors T. Lishman, A. A. Wilson, H. P. J. Murray, W. Blanshard, E. Brayley Reynolds, O.B.E., J. R. Steevenson, O.B.E., J. McCunn, J. E. Wood, M.B.E., T. B. Crawford, W. J. B. Watson, W. F. Jarratt, T. L. Shea, J. J. Dunlop, A. V. Franklin, P. J. Baines, I. S. Maclennan, G. D. Young, M.B.E., E. H. Lewis Bowen, W. Blount, K. A. Haines, M.B.E., A. A. Kidd, R. I. Macrea, T. F. Eardley, D. M. Stewart, A. E. Carey Foster and C. G. Farmer.

Captains P. Mitchell, O. Murch, J. Stratton, W. A. Gibbs, F. L. Alexander, J. Spurry, D. P. White and J. G. P. Wood.

Lieutenants T. A. R. Chipperfield, I. G. C. Cochrane Dyet, R. J. Clifford, F. E. Hunter and J. W. McLeod.

* * * * *

SUDAN VETERINARY SERVICE

Following the recent constitutional changes in the Sudan, the Sudan Veterinary Service has become the Department of Animal Production. This Department and the Department of Game and Fisheries form the newly created Ministry of Animal Resources. The first Minister appointed is Sayed Bullen Alier de Bior.

* * * * *

ACCESSIONS TO THE R.C.V.S. LIBRARY,

The following works have been added, from January to May, 1954, to the Library of the Royal College of Veterinary Surgeons.

Albada, M. van, *and others*: Proefnemingen met varkens enkuikens over de bruikbaarheid. 2nd series. Gravenhage, Staatdrukkerij uitgeverihbedrijf, 1952. Blaine, D. P.: Outlines of the veterinary art. *3rd ed.* London, Boosey, 1826. Baucher, F.: Méthode d'équitation. *4me ed.* Paris, J. Dumaine, 1874. Bartlet, J.: The gentleman's farriery. *9th ed.* London, Nourse, 1777. Brody, S.: Bioenergetics and growth. New York, Reinhold, 1945. Clausen, H.: The improvement of pigs. George Scott Robertson memorial lecture, 1953. Coffin, D. L.: Manual of veterinary clinical pathology. *3rd ed.* Ithaca, Comstock, 1953. Ellenbergler, W., *and* Baum, H. Handbuch der vergleichenden Anatomie der Haustiere. *18 Aufl.* Berlin, Springer, 1943. Fleming, G.: Roaring in horses. London, Baillière, Tindall & Cox, 1889. Frank, E. R.: Veterinary surgery. *5th ed.* Minneapolis, Burgess, 1953. Gray, J.: How animals move. Cambridge University Press, 1953. Great Britain: *Colonial advisory council of agriculture, animal health and forestry.* The improvement of cattle in British colonial territories. London, H.M.S.O., 1953. Great Britain: Foreign Office. Draft constitution of the European commission for the control of foot and mouth disease. London, H.M.S.O., 1953. Hass, K. B., *and* Haas, K. B.: Business practices in veterinary medicine. Kansas, Veterinary Magazine Co., 1953. Halnan, E. T., *and* Garner, F. H.: The principles and practice of feeding farm animals. *4th ed.* London, Longmans, Green and Co., 1953. Honeker, A.: Krankheiten der Ziege, v. 3, Euterkrankungen der Ziege. Dortmund, Kleintierzucht, 1952. Hoskins, H. P., *and others, eds.*: Canine medicine. Evanston, American veterinary publications, inc. 1953. Kenneth, J. H., *and* Ritchie, G. R.: Gestation periods. *3rd ed.* Parnham Royal, Commonwealth agriculture bureaux, 1953. Lupton, J. I.: Horses: sound and unsound. London, Baillière, Tindall & Cox, 1893. Perry, E. J.: The artificial insemination of farm animals. *2nd ed.* New Brunswick, Rutgers University Press, 1952. Pharmaceutical Society of Great Britain: British veterinary codex, 1953. London: Pharmaceutical Press, 1953. Radot, C., *and* Lepine, P.: La myxomatose. Paris, Flammarion, 1953. Scottish Hill Farm Research Committee: Survey of blackface sheep. Edinburgh, H.M.S.O., 1953. Stockowners' Conference: Nairobi, 1936. Report. Nairobi, Govt. print., 1937. United Nations: *World health organisation, and Food and agriculture organisation.* Advances in the control of zoonoses. Geneva, 1953. Vandeplassche, M., *and* Paredis, F.: Caesarean section in the bovine. Paris, "Erasme," 1953. Vodopivec, S., *and others*: O santoninu iz jadranskega morskega pelina. Ljubljana, 1953. Williams, F. L.: Radiology laboratory manual for veterinarians. Detroit, Clark and Wilson, 1952.

As from 1955 the Royal College of Veterinary Surgeons will cease to subscribe to the following journals: *Empire Journal of Experimental Agriculture; Histoire de Medécine; Queensland Agricultural Journal.*

* * * * *

ADDRESSES OF DISEASE-INFECTED PREMISES

The list given below indicates, first, the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

Anthrax:

Durham.—High Scrogg Farm, Middleton St. George, Darlington, June 15).

Leics.—Moat Farm, Loughborough (June 14).

Fowl Pest:

Lancs.—Wiggans Lane, Holmeswood, Ormskirk (June 17).

Leics.—2, The Stockwell, Wymeswold, Loughborough (June 16).

Lincs.—Top Barn Farm, Painton Road, Billingborough, Sleaford (June 15).

Swine Fever:

Beds.—Allotments, New Bedford Road, Luton (June 18).

Cambs.—Allotments, Ascham Road, Cambridge (June 16); "Fair View," Over Road, Willingham (June 19).

Ches.—Hilltop Cot, Anderton, Northwich (June 14); Glenmoriston Home Farm, Eastham, Wirral; Moor-Fields, Whitchurch Road, Rowton, Chester (June 15); Holly Bush Farm, Comberbeach, Northwich (June 16); Mount Pleasant, Aston, Nantwich (June 19).

Denbighs.—The Hollies, Marchwiel, Wrexham, and Pig-sty on Waste Ground, in Carden Road, Moss, Wrexham (June 15); Esless Farm, Rhostyllen, Wrexham (June 16).

Essex.—Mundon Hall Farm, Mundon, Maldon (June 18).

Flints.—Fair View, Llanfynydd, Wrexham (June 18).

Glos.—Partridge Barn, Elm Farm, Staunton, Coleford; 2, Myrtle Villas, Cheltenham Road, East Churchdown, Churchdown (June 19).

Herts.—Highfields Farm, Bassingbourn, Royston; Ashcroft Farm, Holwell, Hitchin (June 15); Broadfield Farm, Cottered, Buntingford (June 16).

Kent.—"Broadview," Lidsing, Boxley, Maidstone (June 15); Speeds Farm, Langton Green, Tunbridge Wells (June 16); Bewl Bridge Farm, Lamberhurst, Tunbridge Wells (June 17).

Lancs.—Heath House Farm, Bold (June 14); Nos. 12 and 13, Smallholdings, Highfield Estate, Levenshulme, Manchester, 19 (June 15); Lower House Farm, Lower House Lane, West Derby, Liverpool, 11; East View, Liverpool Road, Rufford; "Femilea," Southport Road, Formby, Liverpool (June 16); Siddall Moor Farm, Hareshill Road, Heywood; 95a, Starcliffe Street, Great Lever, Bolton (June 17); 1, Mill Road, Ainsdale, Southport (June 18); Landside Farm, Hand Lane, Leigh; Wheathill Farm, Naylors Road, Huyton, Liverpool (June 19).

Lincs.—Woodbine Farm, Gosberton Clough, Spalding (June 16).

Monmouth.—Penylan Farm, St. Brides, Newport (June 16).

Montgomery.—Severn Bank, Forden, Welshpool (June 14); Upper House, Arddleen, Llanymynech (June 16).

Norfolk.—Premises, Sutton Road, Great Yarmouth (June 18).

Notts.—Broad Valley Farm, Bestwood, Nottingham (June 17).

Salop.—"Honwood Farm," Cheswardine, Market Drayton (June 14); The Beeches, Alkington, Whitchurch (June 15); Chipnal Hall Farm, Cheswardine, Market Drayton (June 16); Manor Farm, Preston Grubbalts, Shrewsbury (June 17); Edgerley Hall, Kinnerley, Oswestry (June 18).

Somerset.—Lower Coombe Farm, Crewkerne (June 17).

Suffolk.—East Green Farm, Kelsale, Saxmundham (June 15).

Surrey.—49, High Street, West Molesey (June 14); Merrist Wood, Worplesdon, Guildford (June 16).

Sussex.—West Up Farm, Balcombe, Haywards Heath (June 14); Upstreet Farm, Ovingdean Grange, Ovingdean, Brighton (June 15).

Warwicks.—Woodside Farm, Dutton Lane, Sutton Coldfield (June 18).

Wilts.—Home Stalls, Kilmington, Warminster (June 19).

Yorks.—Silver Ings Farm, Skelmanthorpe, Huddersfield (June 17).

CORRESPONDENCE

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the B.V.A.

CANINE VIRUS DISTEMPER

Sir,—Like one of the speakers in the discussion on Messrs. Larin & Hodgman's paper on Canine Virus Distemper, I do not feel competent to enter into a discussion on such a high scientific level, but I would like to record certain facts which we have found to be of practical importance.

1. In 1950-52 I was privileged to be able to use an injection which I was informed was a suspension of spleen containing virulent distemper virus. This material is the only one which gave consistent (but not infallible) results in *advanced* cases of hard pad. Due to the rapidity of the response to the injection (24 to 48 hours) I feel that this material must have worked by the interference phenomena rather than by antibody stimulation.

2. Hyper-immune serum and avianised virus is of very definite therapeutic value, but is limited in that it has to be given in the early, high febrile stage and repeated in 48 hours.

3. Over 90 per cent. of cases which show a clinical recovery but have a mild pyrexia (102 to 103) for a period of longer than 10 days eventually exhibit signs of CNS damage.

The incidence of hard pad in this practice has been considerably reduced since immunisation with Epivax (avianised virus) has been carried out. This is not due to the local waxing and waning of the disease, which occurs naturally in districts, as it has occurred also in a guard dog school which receives dogs from all over the country and in which we were never free from the disease for more than a week or two. In the last nine months, during which Epivax has been used, we have encountered only two cases in these kennels.—Yours faithfully, PETER J. DALTON, Old Sarum House, Stratford Road, Salisbury. *June 14th*, 1954.

* * * * *

LITERARY LEVITY

Sir,—Under this somewhat frivolous caption I would invite the serious attention of your readers to the following matters:—

On page 317 in the issue of *The Veterinary Record* of May 29th you report the Rt. Hon. Sir Thomas Dugdale, Minister of Agriculture, as having stated that "the poet Burns, in his verses about 'The Yowie (ewe) wi' the Crookit Horn,' mentions immunity from the scab as one of the creature's exceptional merits."

Sir! You will understand my reluctance in venturing to offer correction to one of Her Majesty's principal Ministers of State, but the author of "The Ewie [not the Yowie] wi' the Crookit Horn" was the Rev. Mr. John Skinner (1721-1807), who, for the remarkably long period of 65 years, was the deeply respected and pleasantly convivial minister of the episcopal charge of Longside in Aberdeenshire. He was certainly a contemporary and indeed a "regular and very friendly correspondent" of Burns who said of Skinner's "Tullochgorum" that it was "the best Scotch song Scotland ever saw"!

But, Sir, I have not yet finished with my corrigenda. Well might The Ewie with the Crookit Horn be immune to the scab because she was not a sheep at all, but an apparatus so ingeniously contrived that (when nobody was looking) it could be made to produce more or less potable alcohol. Yes, the thing was an illicit still! The "crookit horn" was, of course, the spirally constructed condenser. So the Reverend Gentleman could sing (doubtless with a gleam of merry mischief in his eye and his tongue poked hard into his cheek),

"O, were I able to rehearse,
My ewie's praise in proper verse,
I'd sound it out as loud and fierce
As ever piper's drone could blaw.
My ewie wi' the crookit horn!
A' that kenn'd her micht hae sworn
Sic a ewie ne'er was born,
Hereabouts nor far awa'.
She neither needed tar nor keel,
To mark her upon hip or heel;
Her crookit hornie did as weel,
To ken her by amang them a'.
She never threaten'd scab nor rot,
But keepit aye her ain jog-trot;
Baith to the fauld and to the cot,
Was never sweirt[1] to lead nor ca'[2].
Cauld nor hunger never dang[3] her,
Wind or rain could never wrang her;
Ance she lay an ouk[4] and langer
Furth aneath a wreath o' snaw."

But, unhappily, the valuable ewie eventually fell victim to a thief . . .

"I never met wi' sic a turn
At e'en I had baith ewe and horn
Safe steekit[5] up; but gain the morn,
Baith ewe and horn were stown[6] awa.
Oh! gin I had the loon that did it
I hae sworn as weel as said it
Though the laird himsel forbid it
I shall gie has neck a thraw." Etc. etc.

Skinner's charming lines were based upon a set of earlier verses which until about 1890 existed only in manuscript and carried the same theme:—

"A' the ewes come hame at even, a' the ewes come hame at even,
A' the ewes come hame at even, crooked hornie bides awa'.
A' the ewes gie milk eneugh, a' the ewes gie milk eneugh,
A' the ewes gie milk eneugh, but crooked horn gies maist of' a'.
Ewie wi' the crooked horn, may you never see the morn,
Ilka day ye steal my corn[7], ewie wi' the crooked horn."

Not in defence of the morals of Mr. Skinner—for that is unnecessary—but maybe by way of explanation of some of his writings, I would add, as a kind of postscript, his own words when speaking of Scottish songs:—

"While I was young I dabbled a good deal in these things; but on getting the black gown, I gave it pretty much over, till my daughters grew up, who, being all tolerably good singers, plagued me for words to some of their favourite tunes, and so extorted those effusions which have made a public appearance beyond my expectations, and contrary to my intentions; at the same time, I hope there is nothing to be found in them uncharacteristic or unbecoming the cloth, which I should always wish to see respected."—Yours faithfully J. RUSSELL GREIG, Wedderlie, Kirk Brae, Liberton, Edinburgh. *June 15th*, 1954.

[1] Reluctant; [2] drive; [3] overcame; [4] week; [5] shut or locked; [6] stolen; [7] the barley.

DISEASES OF ANIMALS ACT, 1950—GREAT BRITAIN

Summary of Returns of Confirmed Outbreaks of Scheduled (Notifiable) Diseases

Period	Anthrax	Atrophic Rhinitis	Foot-and-mouth	Fowl Pest	Sheep Scab	Swine Fever
16th to 31st May, 1954 ...	10	1	—	13	—	91
Corresponding period in—						
1953 ...	17	—	—	30	—	201
1952 ...	25	—	101	3	—	44
1951 ...	16	—	—	7	—	57
1st January to 31st May, 1954	136	1	12	512	—	643
Corresponding period in—						
1953 ...	395	—	25	277	—	1,470
1952 ...	243	—	302	109	1	499
1951 ...	236	—	18	470	4	373

Tuberculosis (Attested Herds) Schemes

The number of Attested Herds, *i.e.*, herds officially certified as free from Tuberculosis as at May 31st, 1954, was as follows:—

England	Wales	Scotland	Total (Great Britain)
58,281	30,491	30,184	118,956